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IS : 9787 - 1981

Indian Standard

CODE OF SAFETY FOR PHOSPHORYL CHLORIDE

UDC 614.878 : 661.638

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July 1981

AMENDMENT NO. 1 DECEMBER 2006
TO
IS 9787 : 1981 CODE OF SAFETY FOR PHOSPHORYL CHLORIDE

(*Page* 4 *clause* 4.1.1) — Substitute the following for the existing text

'Threshold limit value (TLV) of phosphoryl chloride 0.1 ppm'

(CHD 8)

Reprography Unit, BIS, New Delhi, India

Indian Standard

CODE OF SAFETY FOR PHOSPHORYL CHLORIDE

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(*Continued on page* 2)

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(*Continued on page* 8)

Indian Standard

CODE OF SAFETY FOR PHOSPHORYL CHLORIDE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 29 January 1981, after the draft finalized by the Chemical Hazards Sectional Committee had been approved by the Chemical Division Council.

0.2 Phosphoryl chloride, also known as phosphorus oxychloride, is used in the manufacture of cyclic and acyclic esters for plasticizers, gasoline additives, hydraulic fluids, organo-phosphorus compounds, *etc.* It is also used as a reagent; catalyst; and dehydrating, chlorinating and fire-retarding agent. It also finds use as a dopent for semi conductor grade silicon.

0.3 In the preparation of this code, assistance has been derived from the following publications:

a) National Fire Codes 12. National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachussets, 1977.

b) SAX (NI) Dangerous properties of industrial materials 1979. Ed. 5. Van Nostrand Reinhold, New York.

1. SCOPE

1.1 This standard describes the properties of phosphoryl chloride (phosphorus oxychloride); nature of hazards associated with it; symptoms of toxicity and first aid; safety measures for controlling hazards in storage and handling; personnel safety; and essential information on packing and labelling.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 4155-1966[*] and IS : 4167-1980[†] shall apply.

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[*] Glossary of terms relating to chemical and radiation hazards and hazardous chemicals.

[†] Glossary of terms relating to air pollution (*first revision*).

3. PROPERTIES

3.1 Some important properties of phosphoryl chloride are as follows:

a) *Chemical name*	: Phosphorus oxychloride
b) *Chemical formula*	: $POCl_3$
c) *Molecular weight*	: 153·39
d) *Description*	: Volatile, colourless to pale yellow, strongly fuming liquid having pungent odour
e) *Boiling range*, °C	: 105 to 109 for not less than 90 percent (*v/v*)
f) *Freezing point*, °C	: 2
g) *Relative density*, 15·5°C/15·5°C	: 1·685
h) *Vapour density*	: 5·3 (air = 1)
j) *Refractive index* (25/D)	: 1·460
k) *Chemical reactivity*	: Reacts with alcohol; reacts violently with water with evolution of heat and hydrogen chloride gas, apparent as white fumes in air : corrosive to most metals in the presence of moisture

4. HAZARDS

4.1 Health Hazards — Phosphoryl chloride causes severe internal irritation and damage if swallowed. The vapour severely irritates the eyes, skin, and mucous membranes and all parts of respiratory system.

4.1.1 *Threshold Limit Value (TLV)* — The upper limit of phosphoryl chloride vapour concentration considered safe for continuous exposure is 3 mg/m^3 of air.

4.2 Heat Hazards — When heated phosphoryl chloride decomposes into hydrogen chloride and phosphorus oxides which are toxic and corrosive. On coming in contact with water it results in violent reaction and evolution of heat, which may sometimes result in explosion.

5. FIRE FIGHTING

5.1 Fire involving small amounts of combustibles may be smothered with suitable dry chemical. Use water on combustibles burning in the vicinity of this material, but care shall be exercised as water applied directly to phosphoryl chloride results in violent evolution of heat and causes splattering. Full protective clothing shall be worn while handling the operation (*see* **8.1**).

6. STORAGE AND HANDLING

6.1 Storage — Utmost care should be exercised in storage of containers, their handling and emptying of contents. The containers should be stored in a well ventilated, cool and dry place, protected from sun and heat. The containers shall not be stored along with combustible materials particularly fibrous organic containers or with electrical or other equipment that may be corroded.

6.2 Handling — Before moving, it should be ensured that the stoppers are properly closed and the containers are securely packed.

6.2.1 Pressure should not be applied in emptying the containers. Carboys and bottles should be completely drained before they are returned for re-packing or sale.

NOTE — In the case of any spillage of the material, flushing the spot with plenty of water is necessary

6.3 Spills and Leakage — All spills should be covered with sufficient amount of sodium bicarbonate. The mixture should be removed in a container such as a fibre drums, plastic bags or carton box for easy disposal in an incinerator and dispose by burning.

6.4 Disposal and Waste Treatment — The waste should be transferred into an evaporating dish containing sodium bicarbonate. Then, spray with ammonia (6 M NH_4OH) while stirring and cover with crushed ice. Continue spraying with ammonia until the fumes of ammonium chloride subside and add iced water while stirring. Neutralize and slowly transfer mixture into a drain with running water.

7. PACKING AND LABELLING

7.1 Packing — Depending on the quantity, phosphoryl chloride may be packed in steel jacketed lead cylinders, nickel-lined steel drums, glass or plastics carboys or bottles

7.1.1 Small capacity carboys should be covered by close-fitting wicker or bamboo baskets and packed in a wooden slotted crate or iron hampers. Larger capacity carboys should be packed individually in a box or metal drum with inert cushioning and absorbent material.

7.1.2 Bottles should be packed in a wooden crate with inert cushioning and absorbent material.

7.2 Labelling — All containers should bear, an identifying label as depicted in *IS : 1260 (Part I)-1973**.

7.2.1 The containers shall also be labelled as follows:

DANGER

PHOSPHORYL CHLORIDE CAUSES SEVERE BURNS
VAPOUR IS EXTREMELY IRRITATING
USE PROTECTIVE EQUIPMENT WHILE HANDLING
IN CASE OF SPILLAGE FLUSH AREA WITH PLENTY OF WATER

CAUTION

BE CAREFUL WHEN MIXING WITH WATER : HEAT IS EVOLVED

8. PERSONNEL SAFETY

8.1 While handling or emptying containers, complete protective clothing comprising goggles, suitable respirators, caps, rubber gloves, rubber boots and overalls (which cover the neck), should be worn. If the surface of the clothing is contaminated, it shall be thoroughly flushed before attempting to remove the protective clothing. In specific situations, self contained or supplied-air type respirators may have to be used.

8.2 Meticulous personal cleanliness should be observed in all operations. Physical examination including complete blood count, urinanalysis and chest X-ray, dental examination and X-ray should be carried out annually on personnel exposed to risk. Individuals suffering from diseases of the skin, liver, kidneys, lungs and teeth should be precluded from exposure.

9. SYMPTOMS OF TOXICITY AND FIRST AID

9.1 Symptoms of Toxicity — Phosphoryl chloride may lead to toxicity on inhalation or ingestion, causing irritation in the eyes, dermatitis and skin burns.

9.1.1 Inhalation of the vapour causes headache, weakness, vomitting, chest pain, cough, dyspnea, bronchitis and bronchopneumonia, pulmonary edema and nephritis.

9.2 First Aid — In the case of spillage, contaminated clothing should be removed immediately and affected areas of the body washed with five percent (*m/v*) solution of copper sulphate, then with soap and water.

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*Pictorical markings for handling and labelling of goods: Part I Dangerous goods (*first revision*).

Then follow usual burn therapy. For eyes immediate medical attention should be obtained.

9.2.1 In the case of inhalation of vapours, the affected person should be removed to open fresh air. He should be laid in a comfortable position and kept warm. Oxygen should be administered with the use of intermittent positive pressure breathing apparatus. Bronchodilators and decongestants may be given, if necessary. Immediate medical attention should be obtained.

NOTE — Recovery is usually complete in 1 to 3 weeks. However, bronchitis with asthmatic breathing may become chronic.

(*Continued from page 2*)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg m/s^2
Energy	joule	J	1 J = 1 N m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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